Research Review No. 67

November 2007

Price: £3.00

Improving co-ordination and management of HGCA-funded projects on wheat disease control

by

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This is the final report of a project lasting for 6 months which started in October 2006. The work was funded by a contract of £15,000 from HGCA (Project No. 3319).

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1 Introduction

This project was identified during a review of wheat disease management projects presented by R&D and RL staff to the R&D Advisory Committee on 29 June 2006. Currently approximately £1.35 million is spent annually on projects relating to Wheat Disease Management. Existing projects were found to be complementary and to some extent interdependent. The work identified opportunities for exploring improved co-ordination, firmer HGCA ownership, potential cost reduction and overall greater benefits from activities. A call for applications to undertake the review was made in August 2007.

1.1 Project objectives

Principal objectives of the study were:

1) to conduct a detailed review of HGCA-funded wheat disease projects in order to identify areas for improved co-ordination and integration,
2) to review information delivery with a view to improvements and new approaches,
3) to review in the wider context of the UK/EU cereals sector with a view to greater collaboration.

1.2 Methodology

The project was carried out in collaboration with HGCA R&D staff as a member of the team, and conclusions and recommendations emanating from the review were team conclusions. The review centred around interviews with various sectors of the agricultural community. These included end-users, current project contractors, agrochemical manufacturers, independent scientific experts, Government and HGCA staff. Objectives of those interviews were firstly to identify the requirements of HGCA's funders - the end-users, and then to establish how best to deliver those requirements drawing on the views of the remaining interviewees. The team drew on these views in order to help them build up their recommendations.

1.3 Review outputs

Output from the review would be in the form of two reports. The first would be a comprehensive report for HGCA use providing minutes of all interviews together with the personal views of the interviewees. This second summary report would contain the main thrust of the report including recommendations. A presentation to the R&D Advisory Committee and subcommittee would be made in late March/early April 2007 to ensure early endorsement. This was key to ensuring that recommendations for change could be put in place with the contractors by sowing season 2007/08.

2 Current Projects within HGCA Wheat Disease Management (WDM) Portfolio

The wheat disease research projects funded by HGCA evolved to answer specific research questions. Each subsequent project developed to fill the perceived gap in the knowledge and avoided (as far as possible) overlap. Consequently, the portfolio of HGCA-funded projects were not designed starting with a clean sheet. The relationship between WDM projects and the levy payers is presented in Figure 1.

2.1 HGCA Recommended Lists (RL)

Varietal selection has a major impact on the need for fungicide input. The RL trials network provides a well-respected comprehensive database of national and regional information on virtually all commonly grown cereal varieties. The information source is well known and has a high impact. Disease resistance ratings are provided for most diseases as well as Diversification Group information (where appropriate) and data provision on Treated and Untreated trials indicates likely response to disease control. Whilst the RL system is robust, there are still certain opportunities for improvement which, if addressed, could enhance the value of the trials.

No real time information is provided on diseases or on growth stage - indeed, disease assessments (if made) are not analysed until after harvest.

One common observation of the RL system relates to the fungicide programme. From a variety evaluation perspective, data is required on performance in both the presence and absence of disease. However, the high input fungicide programme gives no indication of the ease of disease control. Similarly, it is unclear how to translate disease resistance into reduced chemical input.

Whilst the resistance ratings provided are well understood, they do not relate yield response to degree of disease control. Neither do they provide information to help identify those varieties which perform well with only modest help from fungicides.

Another comment on the RL trial series is that the trials are mostly sown at a similar date and no very early sowings are conducted, simply because it takes time for all breeders to submit their material. However, it is worth noting that supplementary RL mini-plots are sown in Yorkshire and Essex at three sowing dates. These plots extend the information base in terms of impact of sowing date on growth stage (and disease) at two latitudes.

2.2 United Kingdom Cereal Pathogen Virulence Survey (UKCPVS)

Primary end-users of UKCPVS are plant breeders. The work produces varietal Diversification Group information and also picks up changes in pathogen virulence which may necessitate disease resistance rating changes - both key parts of the RL. The data helps to illustrate trends in varietal resistance ratings. Discussions with Rothamsted suggest molecular markers could help with this work (as for fungicide resistance tests) but is some way off - possibly five years.

The data are primarily used for parentage selection in breeding programmes.

Nearly all the data provided are historical - no real time data is provided though occasionally within season Press Notices are released.

There is a close link between this work and similar work conducted for NL with Defra funding.

Diseases assessed include yellow rust, brown rust and mildew - though due to funding restrictions the latter is tested only every second year. No testing is conducted on Septoria, ear or stem base diseases. For each pathogen, up to 50 cultivars are assessed in the field.

2.3 Appropriate Fungicide Dose Experiments (AFD1)

AFD1 is a study of single fungicide a.i.'s compared in different combinations of product x dose. This trial series evolved out of the trials that were originally designed to support DESSAC. Diseases studied are Yellow Rust, Brown Rust, Mildew and both Septorias. Approximately 12 a.i.'s are standard but this depends on the disease. Five different rates are used - 1/4, 1/2, 1, 2 and zero, and the DESSAC developed software allows sophisticated response curve generation and comparison. Products are applied at a single timing between T1 and T2 (GS 33).

There are seven sites for Septoria and 1 each for Yellow rust, Brown Rust and Mildew. There are three standard products - Opus, Bravo and Folicur - with data comparisons in performance available over up to ten years. Many new products are evaluated well before commercialisation. KT is principally through the web-site and through the winter meeting programme and subsequent press articles. Data are made available during the winter - usually by January.

AFD1 is well founded in science and there is general agreement among plant pathologists that the trial series provides useful information. The data help form the foundation upon which fungicide programmes are built. Many questions relate to the timing of the single fungicide application, the curve construction software, and the 'ad hoc' nature of KT provision. In addition no mixtures are tested and the single spray tested in areas selected for disease pressure places the product into an extreme situation.

2.4 Appropriate Fungicide Dose Experiments (AFD2)

The AFD2 trial series commenced in 2004 in order to bridge the gap perceived between the information provided by AFD1 and farm practice. The trial series was restricted to Septoria and had the objectives of

1) establishing the effect of sequences and mixes of fungicides
2) identifying dose and varietal resistance interactions
3) evaluating the response to seasonal disease pressure
4) acting as a test for the predictive nature of AFD1

The varieties selected for trial are based on their Septoria resistance ratings - Consort (3) Einstein (5) and Robigus (7). There are 4 sites - Norfolk, Herefordshire, Hampshire and the Borders. There are four application rates, 0, 1/4, 1/2 and 1. This has been a successful trial series which has confirmed the benefits and principles of mixtures and sequences and has shown dose variety interactions. It has also provided data for testing the predictability of AFD1. However, by its very nature, only a limited number of products can be tested, no real time data is produced and the work is limited to one disease (Septoria).

2.5 CropMonitor

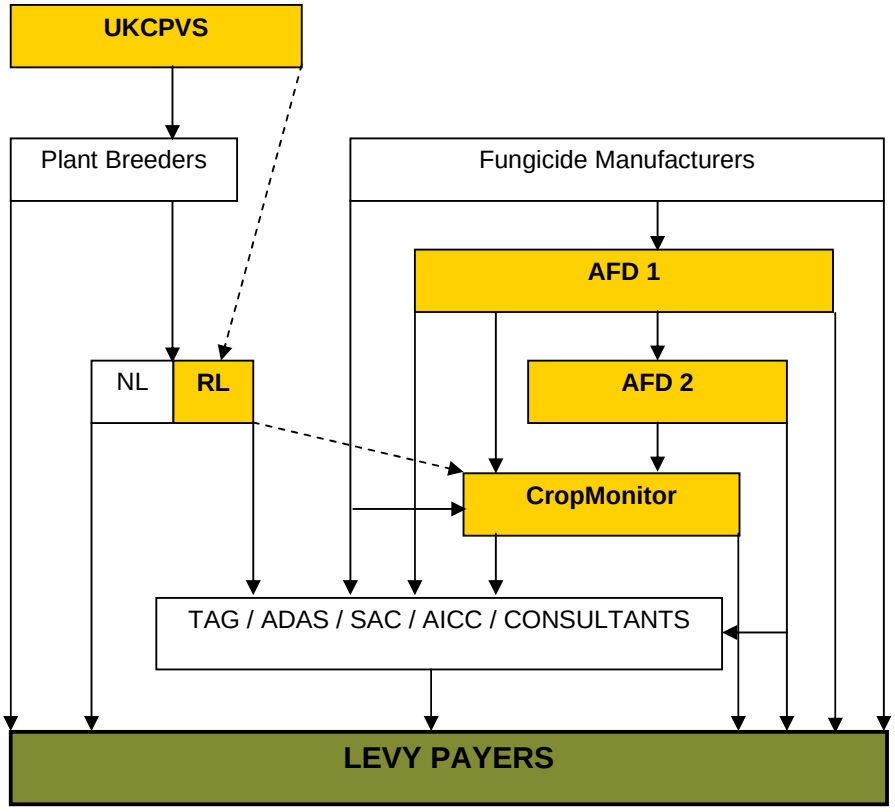
CropMonitor consists of a website which provides real-time information based on live-monitoring of a network of trials. Contributors to the 'project' include ADAS, TAG, AICC, SAC and commercial companies with National and Regional Commentators of wide on-farm experience writing editorials for the web pages. It evolved from the DEFRA-funded Crop Pest and Disease surveys where it changed into a live monitoring system. The website is good with rapid turnaround of contributed data using good disease predictive models and automatic graphic techniques to provide useful and timely information

helping growers in their decision making. HGCA supports the CropMonitor web-site (and some analysis) to the extent of £30k per year.

While the concept of CropMonitor is good, there are certain weaknesses within the current system. Data supplied does not necessarily come from a representative spectrum of crops. The trials network used duplicates to a certain extent the CEL RL trials network. The regions used do not correspond to any other regional system (e.g. RL) and may relate to old ADAS regions.

However, these criticisms are not fundamental. CropMonitor is a relatively new ‘system’ and is still evolving. It is relatively low profile, yet with promotion, it could be a major force in helping decision making on farm. CSL do not see themselves as providers of on-farm advice and are not seeking self-promotion through the website. However, HGCA quality control and project monitoring mechanisms are not in place. In addition, the web-pages logo implies that HGCA is supporting pulses and potatoes as well as cereals and oilseed rape.

Figure 1 Relationship between WDM projects and levy payers



3 Way forward

The aim of this section is to collate according to sector the views of the stakeholders interviewed so providing a basis on which to build recommendations for change. It should be emphasised, however, that it is the views of the levy-payers that should be paramount rather than the views of the researchers - it is the levy-payers who pay for the research. Consequently it is first necessary to identify the information required by the levy payer, secondly identify the best and most efficient KT methods for delivering that information, and only then decide on the research that needs to be done to fill information gaps taking into account sources of usable information already funded.

3.1 Information required

One critical aspect relating to HGCA's supply of information to the levy-payer is the level of detail it is appropriate to provide. This is presented schematically in Appendix 1. Information can be provided in progressively more detail but at some point that information transforms into advice. The provision of advice raises issues over appropriateness, responsibility and risks of litigation. In order to establish the views of levy-payers and others, a short questionnaire was used with attendees at several HGCA update meetings over the 2006/7 season (see Appendix 2).

3.2 End-users' views

For the purposes of this review, end-users are seen as levy-payers (growers) and the consultants who supply levy-payers with 'packaged' information and advice. (See Figure 1 Relationship between WDM projects and levy-payers).

Levy Payers

Answers to the questionnaire from levy payers showed surprising consistency. All growers were aware of the Recommended List, most knew about AFD1 - less about AFD2, few had heard of CropMonitor and none were aware of UKCPVS. A considerable proportion of growers interviewed expressed the desire for evaluating varieties at an intermediate fungicide treatment level - one more applicable to normal commercial practice. Views on level of information supply were equally consistent. Growers wanted as much information as possible synthesised as far as possible into on-farm usable messages. Little concern was expressed regarding conflicts of interest, or litigation risks that would be faced by HGCA.

Consultants

The views of consultants on both the value of current HGCA WDM projects and the level of information appropriate for HGCA to provide followed the same pattern as for growers - RL universally supported but with a request for an intermediate fungicide level. AFD1 was generally supported but with suggestions for two applications (T1 - T2); there were some reservations over AFD2, little knowledge/awareness of CropMonitor, and even less for UKCPVS. Consultants expressed concern over the delay in receiving AFD1 results and some expressed confusion over non-consistent messages from the trials at presentations.

Their views on appropriate information provision were very clear. HGCA should go as far as level 5 on Appendix 1, but no further. Consultants clearly felt threatened by the provision of 'packaged' information.

3.3 Contractors' views

The contractors involved in the current HGCA WDM project portfolio provided a range of views on the way forward. A general observation was that links between all the WDM projects were good because it was largely the same 'club' of contractors that conducted the work. These contractors saw each other regularly at project management meetings and were in touch with each other frequently.

There was uniform support for RL in terms of its structure organisation and results provision. A frequent comment was that as RL had UK coverage with standardised trials protocol, more could be made of the investment, for example, by providing real-time information on disease occurrence and development on a varietal/regional basis. There were suggestions for more Untreated trials - some feeling that too much emphasis was placed on Treated performance. Interest was also expressed in an intermediate fungicide level RL for a few key selected sites across the UK. The suggestion was for a fungicide level at a low rate - possibly 1/3 of the current level.

Although acknowledged as information primarily of interest to breeders, UKCPVS was seen as important and a necessary support to the RL.

For AFD1, there was general agreement among the contractors that AFD1 was well founded in science. The large data set that had been built up over the years provided useful opportunities for year by year comparisons of fungicide performance. Indeed, it was hoped that HGCA held the data in a form whereby contracts might be offered in the future to conduct 'data-mining' type projects. However, in parallel, there was concern that year-on-year comparisons when taken out of context and publicised within season, might infer greater a.i. deterioration in performance than might be the case in practice.

There was considerable concern that new a.i.’s were not being provided for the AFD1 trial series. If this continued, then the value of the series could collapse. In the short term, the organisers might be pushed into testing mixtures to maintain trial interest. However, it was also felt that offering companies the option of paying to have their own co-formulated products tested could achieve this and underpin rising costs.

There was some concern at the 'black-box' element of the software used to generate fungicide performance curves and the 'surprises' this sometimes provided - particularly in relation to the first point of the curve.

There was considerable support for the proposal of a more structured KT calendar for results provision.

AFD2 was seen as a means of bridging the gap between AFD1 and farm practice. A range of views was expressed on the value of AFD2. Some considered it unnecessary, as the AFD2 results should be predictable by AFD1. Others criticised it in terms of the inability to test all the combinations/sequences of products available. However, a converse view was that AFD2 was a useful research tool for exploring whether the concept of mixtures, and sequences of mixtures worked, and how effective they were on varieties of differing resistance ratings. However, from this perspective, AFD2 had done its job.

There was general appreciation of the value of CropMonitor. All contractors saw the value in providing information tracking disease development through the season on a regional basis.

There were clear opportunities for further developing CropMonitor in the future. It was felt that there was some duplication between CropMonitor sites and the RL sites and consequent opportunities for rationalisation. RL protocols could be adjusted to provide CropMonitor with plant samples and better links could be developed with the remaining WDM projects. The need for maintaining independence from the main commercial players was expressed. CSL were seen as an even-handed organisation without major on farm crop consultancy interests and were thus suitable host for co-ordinating such a major resource.

3.4 Agrochemical industry views

Some very useful observations were provided by the agrochemical industry. However, there was a lack of consistency in the views on the way forward - possibly coloured by commercial interests. There was consistency of opinion regarding RL, UKCPVS and CropMonitor.

There was uniform support for RL and its value to the whole industry though one company questioned choice of fungicide for the Treated programme. UKCPVS was seen as low priority and doubt was expressed whether farmers actively used Diversification Group information in their varietal choice. Questions were even raised as to whether resistance ratings came into play to a large extent in varietal choice. CropMonitor received universal praise in terms of its value.

There was a mixed bag of views regarding AFD1 and AFD2. Some felt AFD2 had been useful being closer to actual practice but had done its job. Other views were that AFD2 would have to be huge (providing many more combinations) to be of use. All agrochemical companies were critical of AFD1. A range of views was expressed - particularly in relation to the single spray. Some felt that a spray half way between T1 and T2 pleased nobody. As products were more suited to T1 or T2, one suggestion was to split AFD1 in two and have a T1 trial and a T2 trial. Others felt two spray timings should be applied, at T1 and T2. Others felt that if it were to be at a single timing, then it should be delayed to GS39.

There was some limited support (company related) to include proprietary mixes. As there were almost limitless numbers of these products, then only market leaders should be included. The concept of paying for inclusion of products was not picked up enthusiastically but companies were not completely averse to the concept.

All companies felt that better KT management was required. Ideally, information should be supplied much earlier than at present and in a much more transparent way. Formal notification of results to manufacturers would be useful (c.f. RL). A more accessible database would be appreciated. Data should be released in a standard format on an agreed date rather than at a Roadshow.

Concerns over AFD1 have resulted in one company not providing new a.i.’s to AFD1. Another company is considering doing the same. The issue of referring to products by

brand names or a.i. names was raised - it was shown that the original manufacturer's product out-performed other formulated copies.

Any group formed in the future to manage the WDM portfolio should not include individual company representatives - tensions/competition between the companies is too severe for this to take place.

3.5 Independent experts

Key issues identified by the experts included:

- the development of markers which can indicate the proportion of Septoria ascospores resistant to a fungicide in real time
- the benefits of maintaining an AFD1 simply to maintain continuity in assessing changes in fungicide performances
- the need for greater WDM project co-ordination perhaps on the lines of RL
- AFD1 management issues
- risks of new molecules not being made available for evaluation
- the need to test predictability of AFD2 results from AFD1
- The use of an intermediate RL fungicide level to put a value on disease resistance.
- The use of RL as a model system for HGCA's management of WDM work.
- better WDM co-ordination of experimentation
- better WDM integration of experimentation
- Better KT management - particularly in relation to earlier date of data release
- Response curves should include Margin over Fungicide
- The impact of influence of grain prices and fungicide costs on responses should be available.
- Opportunities for improved KT for UKCPVS should be explored.
- Current co-ordination of WDM projects exhibit strong ownership - more openness should be encouraged.
- CropMonitor appears to be the natural conduit for HGCA disease work
- Good short expert opinion is crucial to a successful CropMonitor.
- Predictive models should be linked to CropMonitor where possible.

3.6 Government views

The recent re-organisation of Defra coupled with yet greater emphasis on environmental rather than food security is unlikely to be helpful in terms of Defra supporting fungicide work. However, if CropMonitor was seen to receive greater cross-industry support then this would encourage Defra's continued funding.

At the NL/RL UKCPVS level, Defra indicated a willingness to adapt current protocols if that would improve the information provision and increase the value of the work they funded.

4 Recommendations

1) CropMonitor

HGCA takes greater 'control' of CropMonitor and provides a long term commitment to funding it.

CSL remains the holder of CropMonitor but HGCA introduces QA monitoring and develops editorial control.

CropMonitor becomes a 'one-stop-shop' for crop information and hyperlinks are developed to RL information, Topic Sheets etc.

HGCA raises the national profile of CropMonitor. Championing CropMonitor and securing its worth should help rather than hinder continued Defra funding.

RL trials are used to provide plant samples (thus avoiding duplication).

2) RL

There is a tentative recommendation that varieties should be evaluated at an intermediate fungicide level at a limited number of sites (perhaps 4) in addition to the standard Treated and Untreated Blocks. The objective of this is to assess performance with modest fungicide help and to gain a clear picture of the shape of the response to fungicides. (cf fungicides and variety interaction of AFD2 paper later in this paper.). If this were to go ahead then it should be a separate stand-alone project from a project management perspective. Further discussions should take place on the nature of an intermediate fungicide level (i.e. dose level, product choice), the variety range that should be included, and the number and siting of these trials.

A further cross-referenced recommendation is that the RL trials network is used for supplying QA'd samples from across the network for CropMonitor work.

3) UKCPVS

It is recommended that opportunities for KT be sought as soon as practicable. In particular, links to CropMonitor and information provision should be explored.

It was also recommended that 3/4 years hence a review of the need for UKCPVS should be conducted particularly in relation to scientific development of molecular marker techniques which may have superseded current methodologies.

It was tentatively recommended that Rothamsted's work on pathogen populations resistant to fungicides be explored for information provision to CropMonitor.

4) AFD1/AFD2

Commission Review on Predictability of AFD2 from AFD1 (NB: This was commissioned during the life of this review)

Cease AFD 2, as results can be predicted within reasonable scientific error by AFD 1.

Replace AFD 2 with an RL Intermediate Fungicide Treatment level at (possibly) 4 regionally selected RL sites [cross-referred with RL recommendations].

Include proprietary a.i. mixes within AFD 1.

Introduce fungicide application timing as factor within AFD1 trial structure.

Establish stakeholder management committee for managing cereal disease management projects (cf. RL).

This management committee to review product selection, protocols, review data and meet at key calendar dates.

This management committee to represent all industry sectors (as with RL) with CPA representing agrochemical manufacturers.

Data management from disease management projects to be brought in-house.

Management Committee to authorise trial protocols, and trials work to be put out to tender.

Establish dates for data 'launch'.

5 Overarching Issues

With HGCA taking control of WDM projects, there needs to be a Champion identified within the organisation who acts as a fixed point for committee organisation and as end-user point of contact. This individual will need to be skilled in people management and have a good working knowledge of plant pathology. Existing R&D staff are hard pressed so if this duty falls to an existing staff member, then there will be a need to look for additional support to handle existing duties.

Acknowledgements

The authors are grateful to the following for their contributions to the review.

Dr Rosemary Bayles, NIAB
Mr Alan Bide
Dr Fiona Burnett, SAC
Dr Bill Clark, ADAS
Mr David Cooper, Defra
Ms Alison Daniels, Bayer
Ms Sharon Elcock, CSL
Dr Bart Fraaije, Rothamsted Research
Mr Nigel Godley, Bayer
Ms Beth Hall, Syngenta
Dr Stuart Knight, TAG
Professor John Lucas, Rothamsted Research
Mr Andy Mitchell, PVRO
Dr Donal Murphy-Bokern, Defra
Mr Jim Orson, TAG
Dr Simon Oxley, SAC
Dr Neil Paveley, ADAS
Mr John Peck, BASF
Mr Huw Phillips, Scottish Agronomy
Mr David Ranner, Syngenta
Mr Mike Reed, Bayer
Dr Judith Turner, CSL
Mr Steve Waterhouse, BASF
15 Independent Agronomists
Farmers and Growers attending HGCA's Winter Programme
HGCA staff

Appendix 1

Level of Information Appropriate for HGCA to supply

Options

1) WDM results provided as and when they come out as at present

2) As above, but aim for more rapid provision and coordination

3) Choice of variety X Choice of fungicide (this years or last year's results) - can provide at start of season

4) Choice of variety X Choice of fungicide X Growth stage

Real time decisions based on Crop Intelligence

Crop Monitor Level

5) Choice of Variety X Choice of fungicide X Growth stage X Disease pressure Information

More detailed intelligence required – diseases.

6) As above with broad guidance on application rates for different fungicide choices

Crop Protection Reports eg SAC, ADAS

7) As above
+ insecticide decisions
+/- herbicide decisions
+/- growth regulator decisions
+/- micro-nutrient decisions

Agronomy Bulletin

8) As above
+ husbandry (sowing dates/ seed rates/nutrients)
+ rotations
+ grain marketing issues

Agronomy Groups & Individual Agronomists

9) As above where rates are prescription based on and local distributor prices and tailored more to the very local area or individual (plus other on farm issues – perhaps even political)

Appendix 2

WHEAT FUNCIGIDE PROJECT QUESTIONNAIRE

1) Which of the following HGCA-funded research relating to wheat diseases are you aware of?

Recommended List ☐

UK Cereal Pathogen Virulence Survey ☐

Fungicide Dose Response Trials ☐

CropMonitor ☐

None of the above ☐

2) Which information sources do you use when deciding on disease control in wheat?

Recommended List (Resistance Ratings) ☐

UK Cereal Pathogen Virulence Survey ☐

Fungicide Dose Response Trials ☐

CropMonitor ☐

Other HGCA information sources ☐

Other non-HGCA information sources ☐

3) **What level of detail do you require in the information you use to decide on fungicide application to your wheat? Should HGCA be providing that information?**

		Level of information you use	**Level of information HGCA should provide**
Level 1	Fungicide Group (eg strobilurin) characteristics Variety characteristics	☐	☐
Level 2	Fungicide Group (eg. Strobilurin) characteristics Variety characteristics Crop Growth stage in your locality	☐	☐
Level 3	Fungicide Group (eg. Strobilurin) characteristics Variety characteristics Crop Growth stage in your locality Disease incidence in your locality	☐	☐
Level 4	Optimum Fungicide Group mixes (eg ^{2}/3 strobilurin + ½ triazole) Variety characteristics Crop Growth stage in your locality Disease incidence in your locality	☐	☐
Level 5	List of best product mixes to choose from (eg. 0.6 l/ha Opus + 1 l/ha Bravo) Variety characteristics Crop Growth stage in your locality Disease incidence in your locality	☐	☐
Level 6	Product mix you should apply (eg. 0.6 l/ha Opus + 1 l/ha Bravo) Variety characteristics Crop Growth stage in your locality Disease incidence in your locality	☐	☐

4) Which sector of the agricultural industry do you represent?

Farmer/grower ☐

Independent advisor ☐

Contractor ☐

Plant breeder ☐

Agrochemical supplier ☐

Researcher ☐

Other ☐

5) Any comments on the sort of wheat disease control information HGCA should supply levy-payers with?